

Figure 1

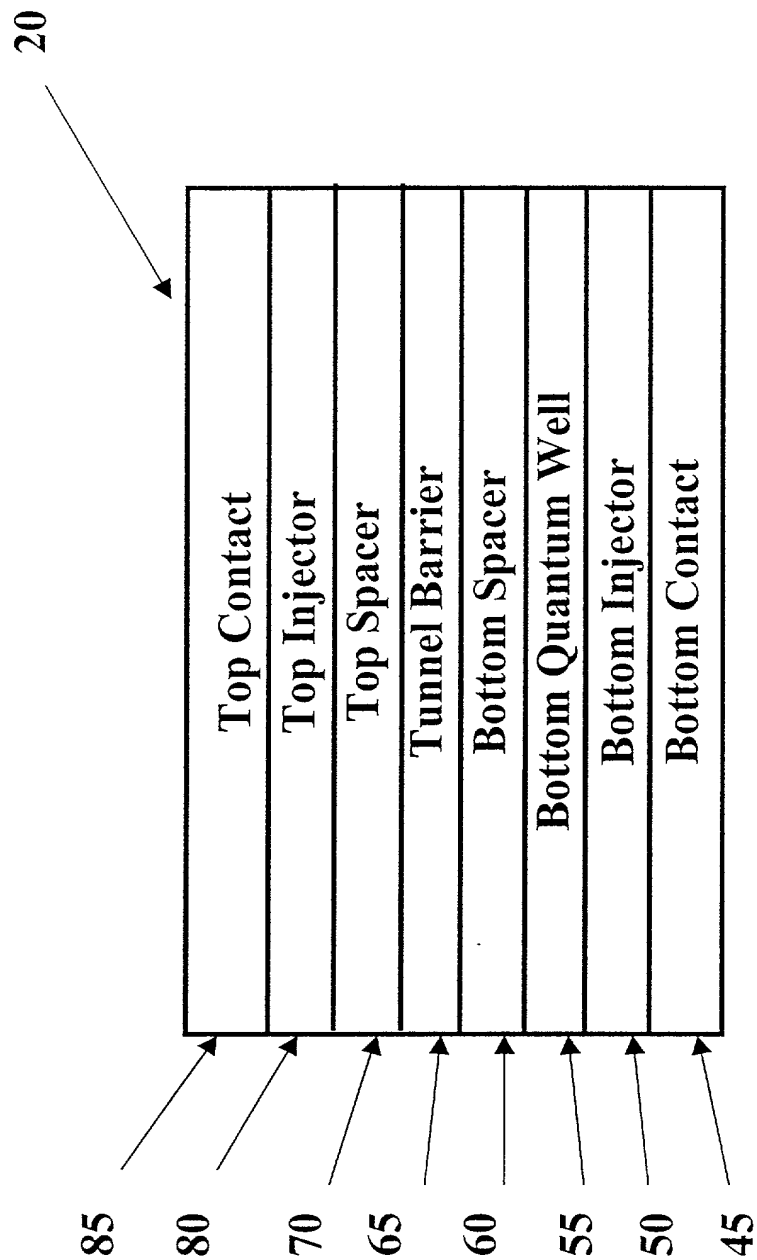


Figure 2

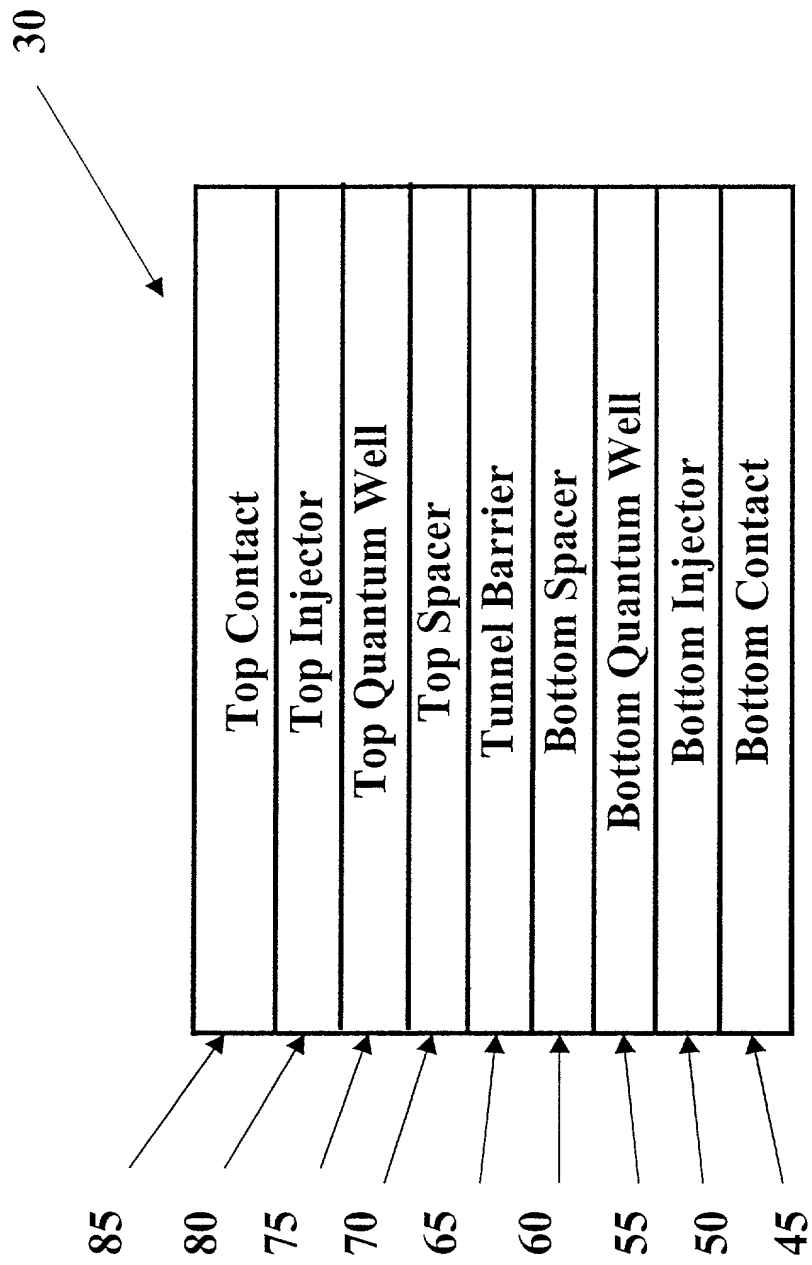


Figure 3

| |
|---|
| ~50 nm n+ Si |
| 20 nm n++ Si |
| 4 nm undoped Si |
| 5 nm p+Si/Si _{0.5} Ge _{0.5} DG-SL 5 periods |
| B δ-doping plane |
| 5 nm p+Si/Si _{0.5} Ge _{0.5} DG-SL 5 periods |
| 100 nm p+Si |
| p+ Si substrate |

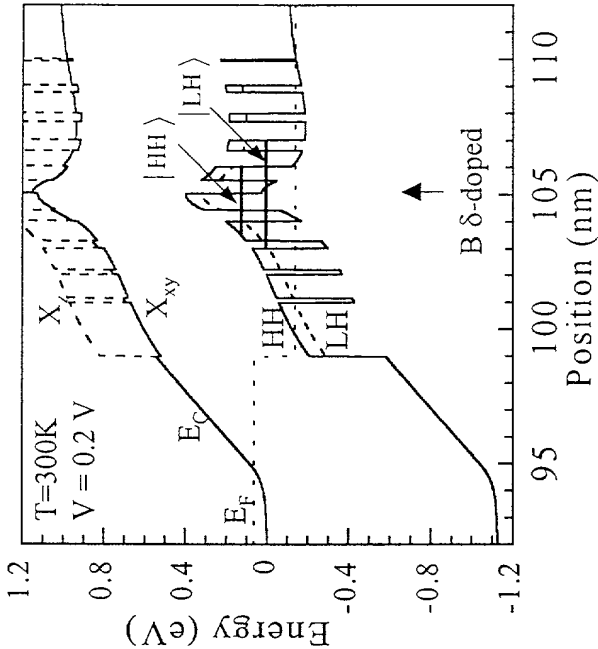


Figure 4

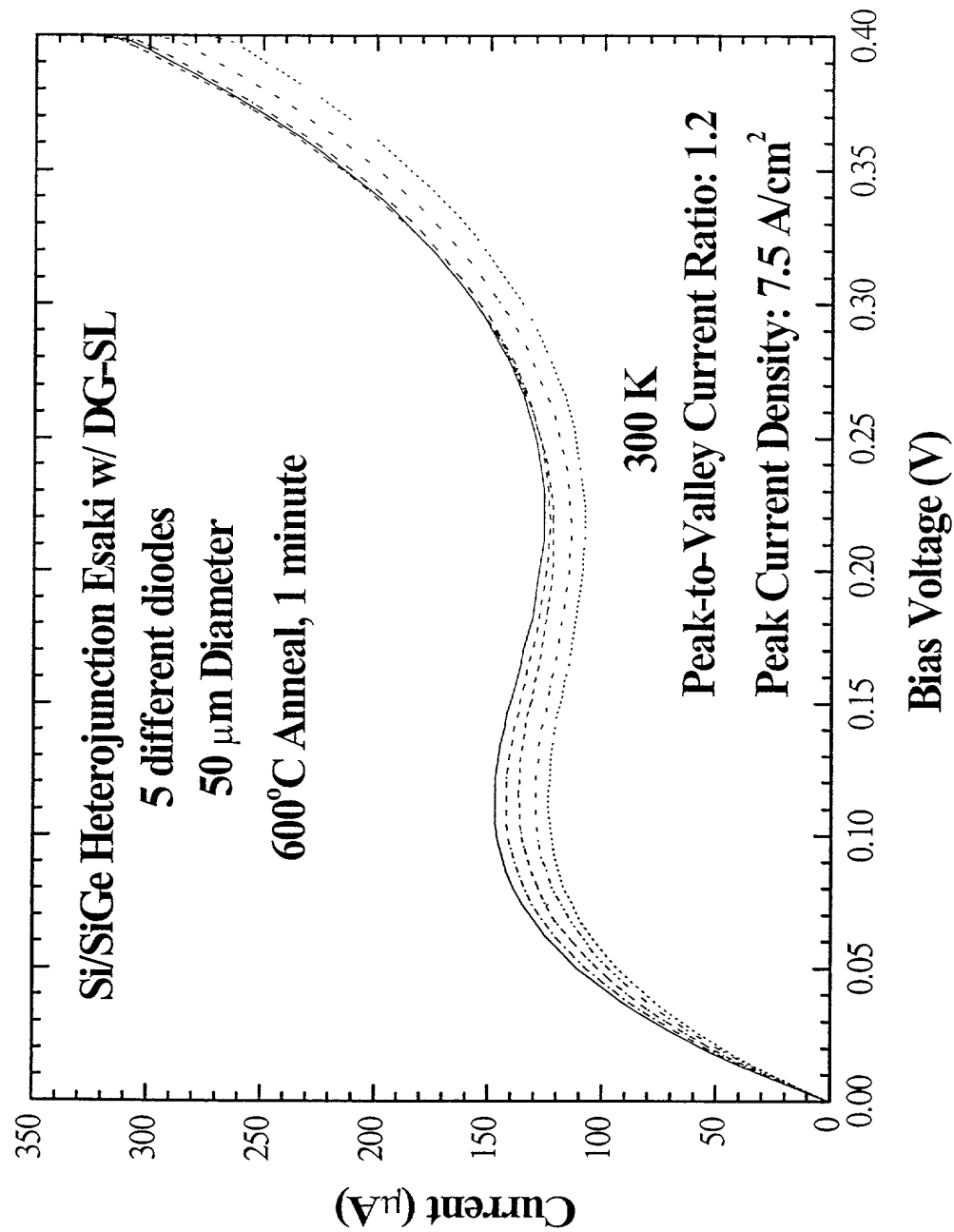


Figure 5

| | |
|--|--|
| 100 nm n+ Si | 100 nm n+ Si |
| Sb-delta doping plane | Sb-delta doping plane |
| 1 nm undoped Si | 1 nm undoped Si |
| 4 nm undoped Si _{0.5} Ge _{0.5} | 4 nm undoped Si _{0.5} Ge _{0.5} |
| 1 nm undoped Si | 1 nm undoped Si |
| B-delta doping plane | B-delta doping plane |
| 100 nm p+Si | 100 nm p+Si |
| p+ Si substrate | p+ Si substrate |

TD1

TD2

(a)

(b)

Figure 6

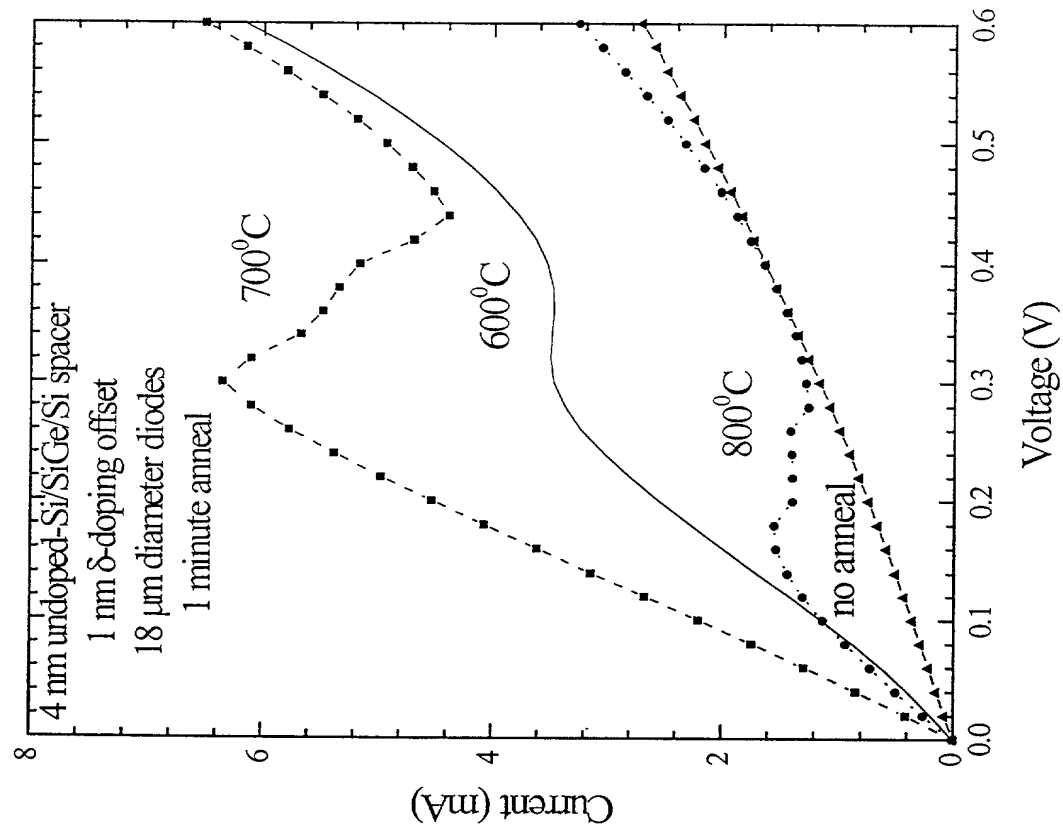
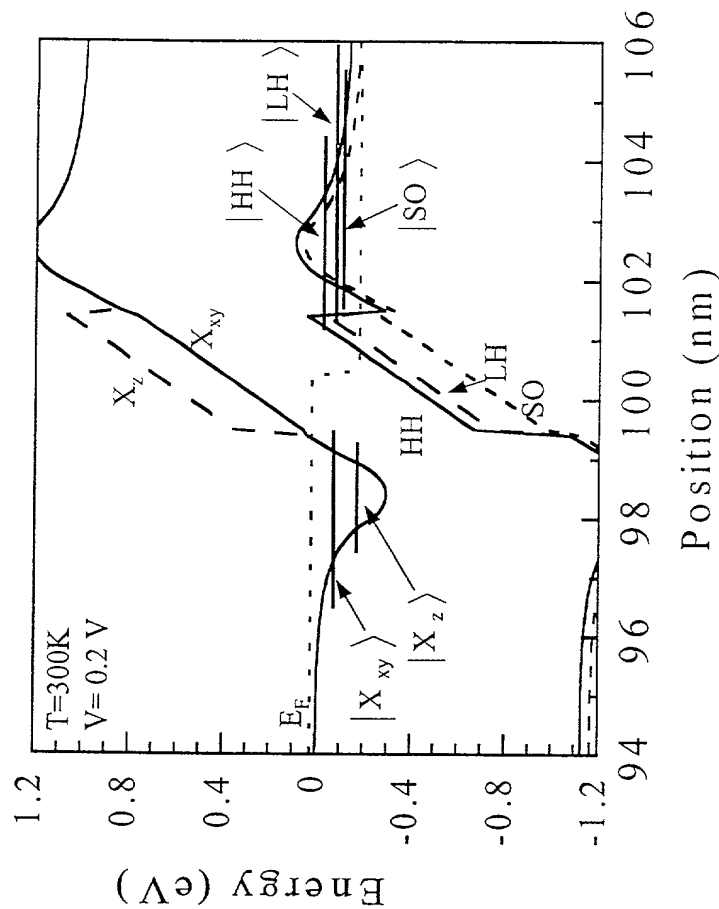


Figure 7

| |
|--|
| 100 nm n+ Si |
| Sb δ -doping plane |
| 1 nm undoped Si |
| 2 nm undoped Si _{0.5} Ge _{0.5} |
| 1 nm undoped Si |
| B δ -doping plane |
| 100 nm p+Si |
| p+ Si substrate |

TD3

(a)



(b)

Figure 8

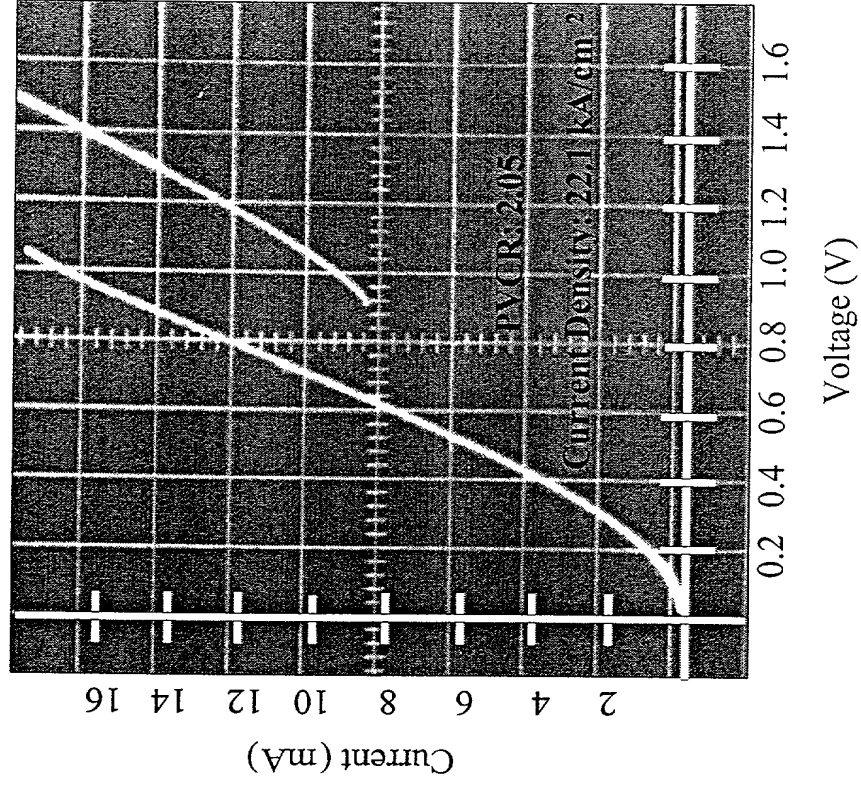
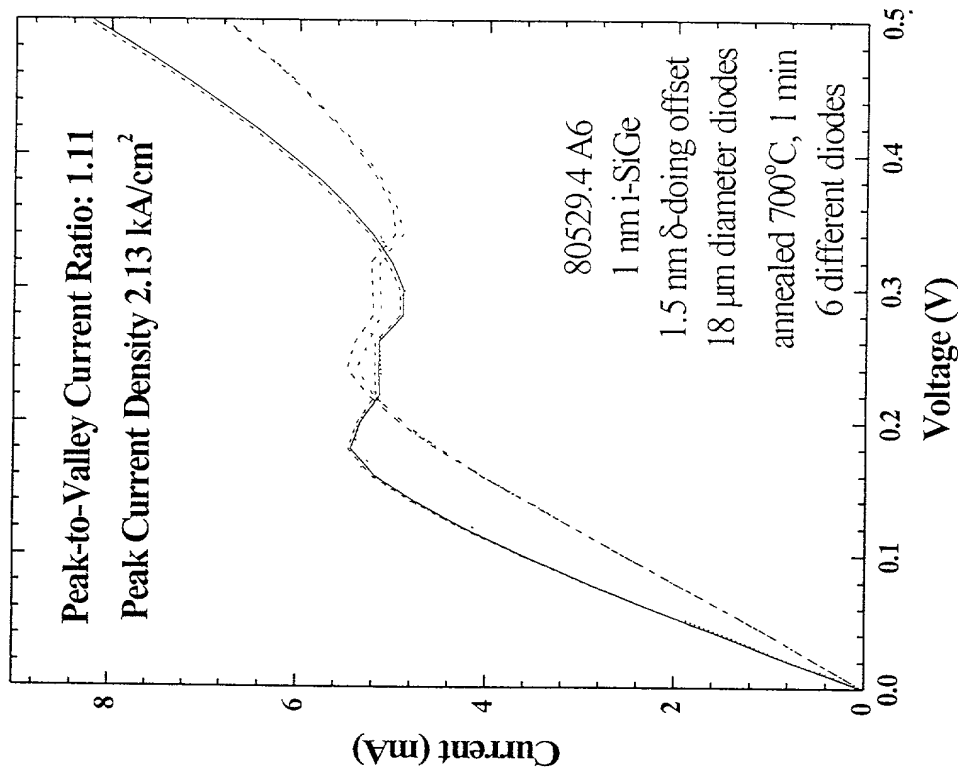


Figure 9

| |
|--|
| 100 nm n+ Si |
| Sb δ -doping plane |
| 1.5 nm undoped Si |
| 1 nm undoped Si _{0.5} Ge _{0.5} |
| 1.5 nm undoped Si |
| B δ -doping plane |
| 100 nm p+Si |
| p+ Si substrate |

TD4

(a)



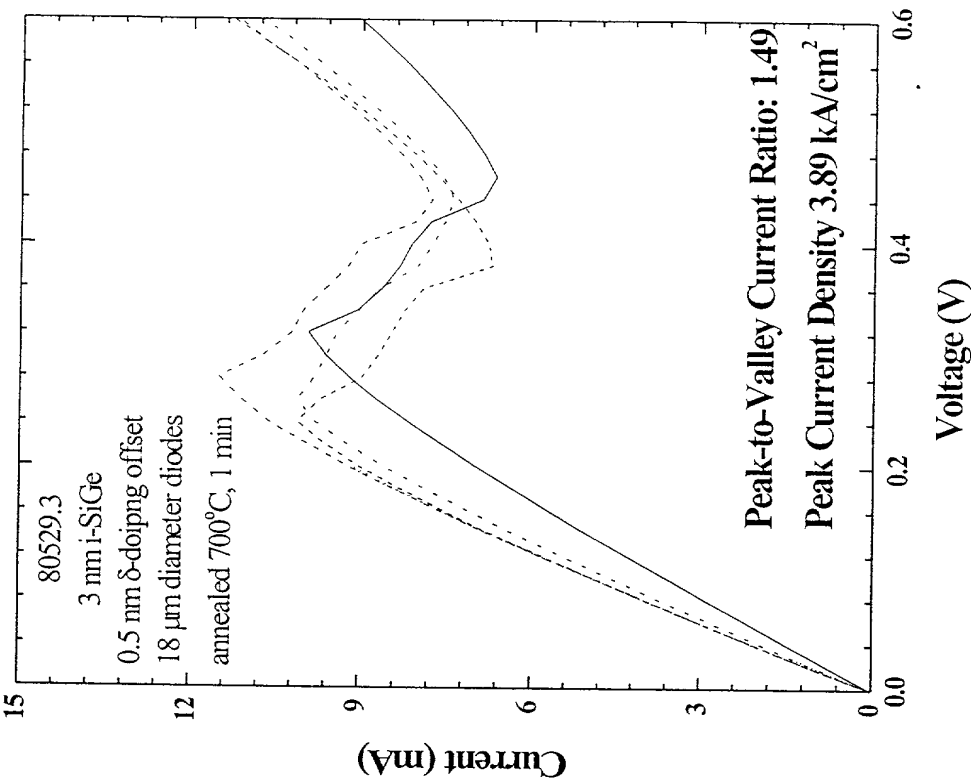
(b)

Figure 10

| |
|---|
| 100 nm n+ Si |
| Sb δ -doping plane |
| 0.5 nm undoped Si |
| 3 nm undoped $\text{Si}_{0.5}\text{Ge}_{0.5}$ |
| 0.5 nm undoped Si |
| B δ -doping plane |
| 100 nm p+Si |
| p+ Si substrate |

TD5

(a)



(b)

Figure 11

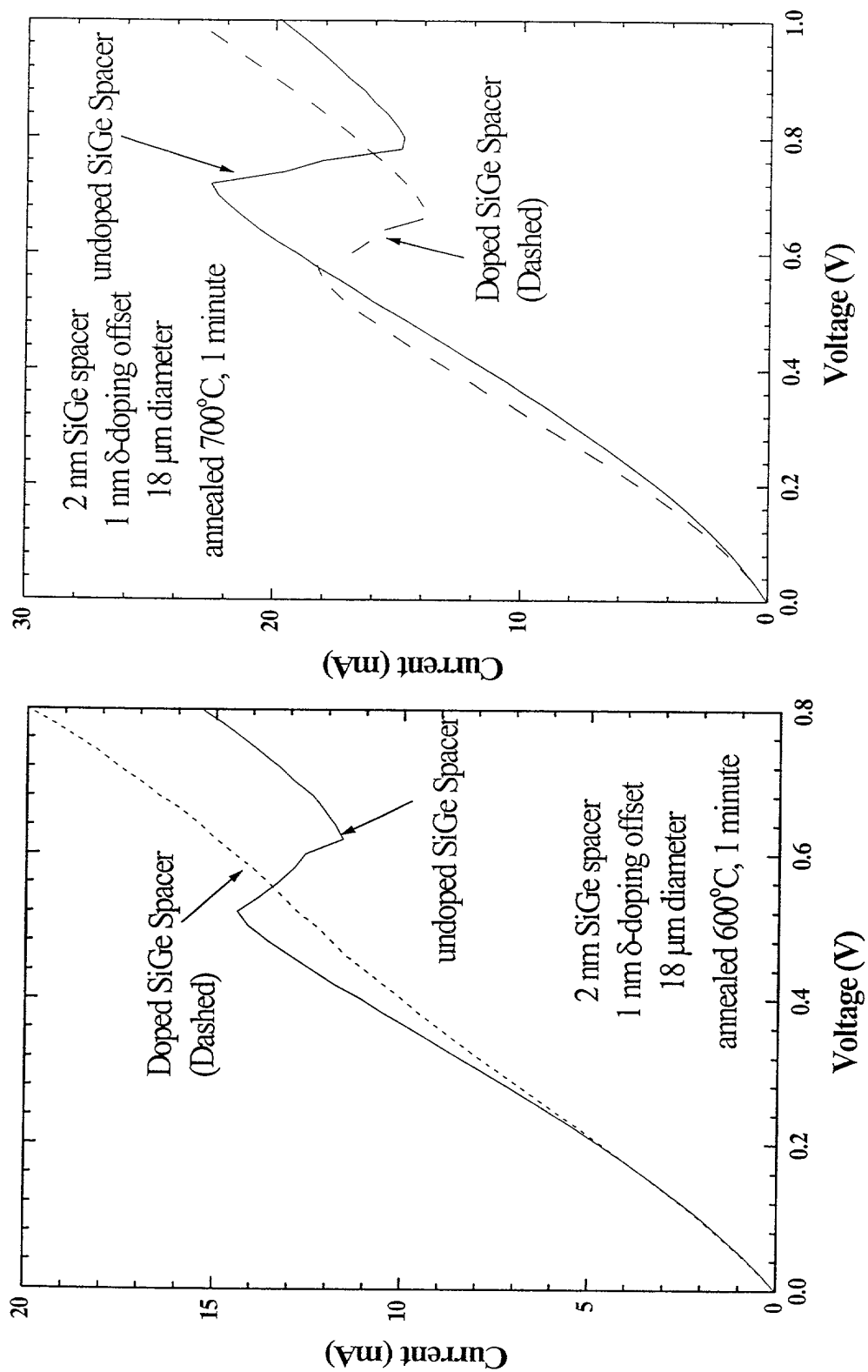
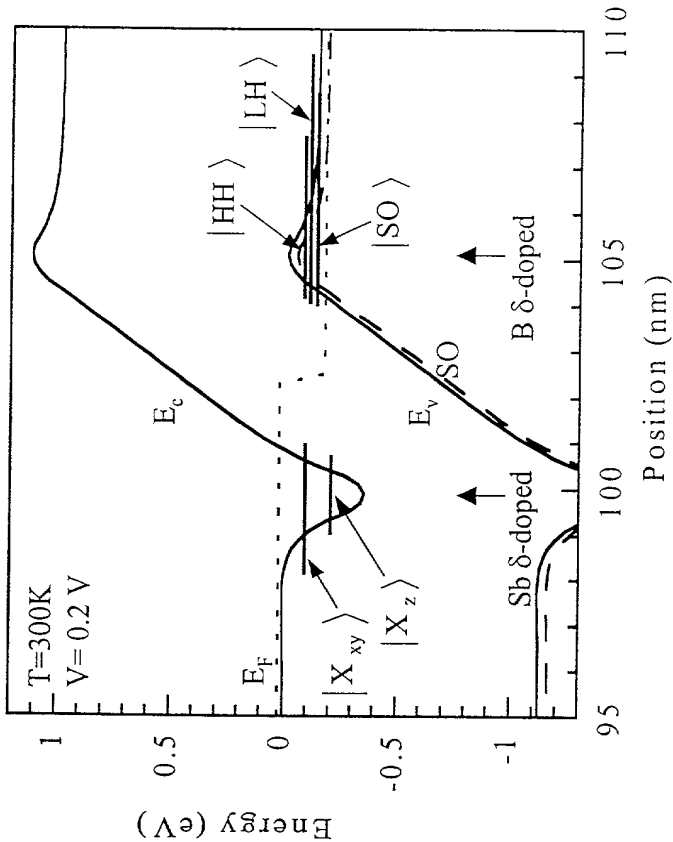


Figure 12

| |
|---------------------------|
| 100 nm n+ Si |
| Sb δ -doping plane |
| 4 nm undoped Si |
| B δ -doping plane |
| 100 nm p+Si |
| p+ Si substrate |

SiTD1

(a)



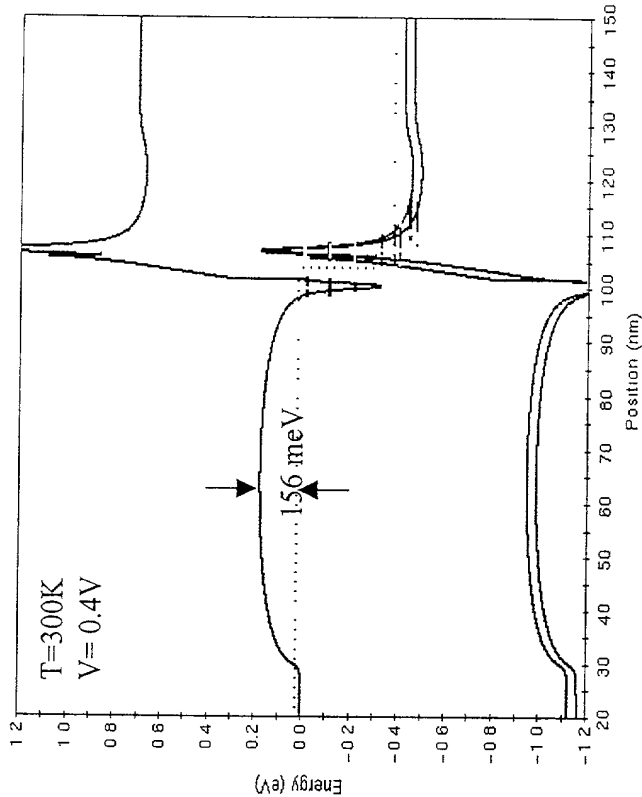
(b)

Figure 13

| |
|---------------------------|
| 100 nm n-Si |
| Sb δ -doping plane |
| undoped Si Tunnel Barrier |
| B δ -doping plane |
| 100 nm p-Si |
| p+ Si substrate |

SiTD (Series II)

(a)



(b)

Figure 14

F0729.4 6 nm Series II Si RTD

SIMS performed by D. Simmons, NIST

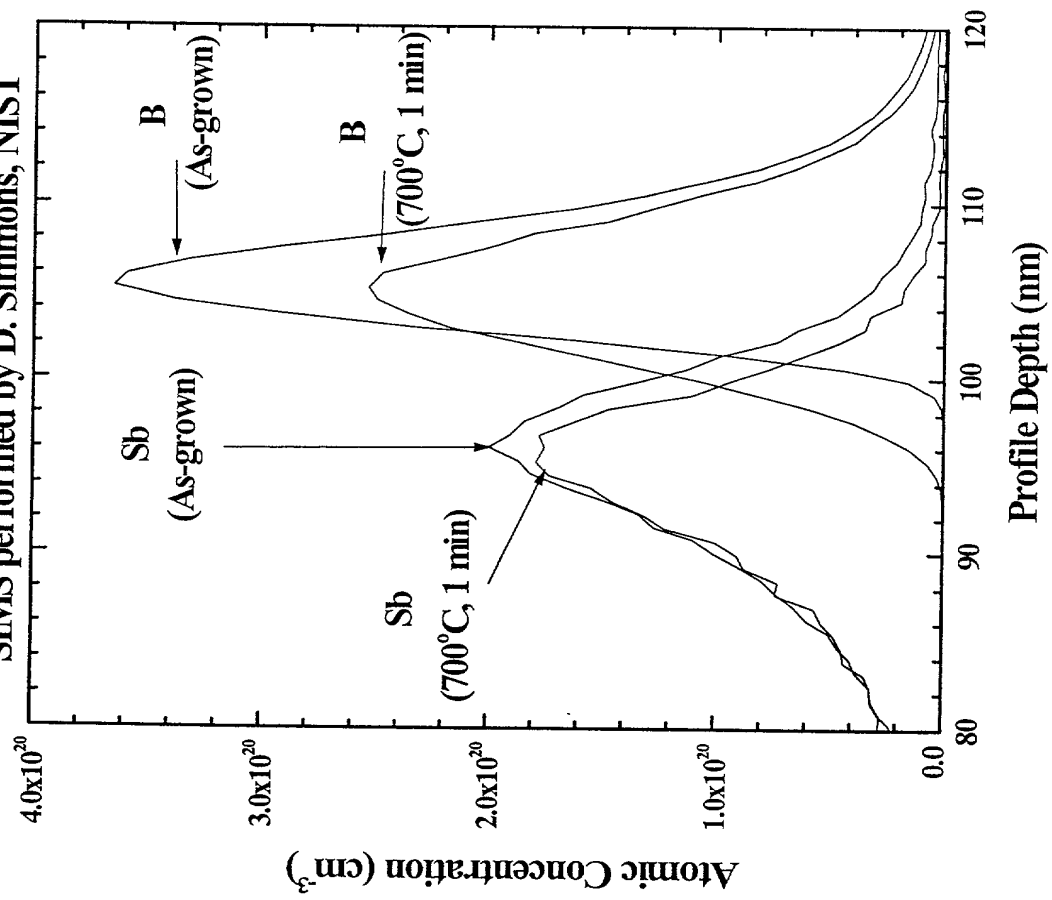
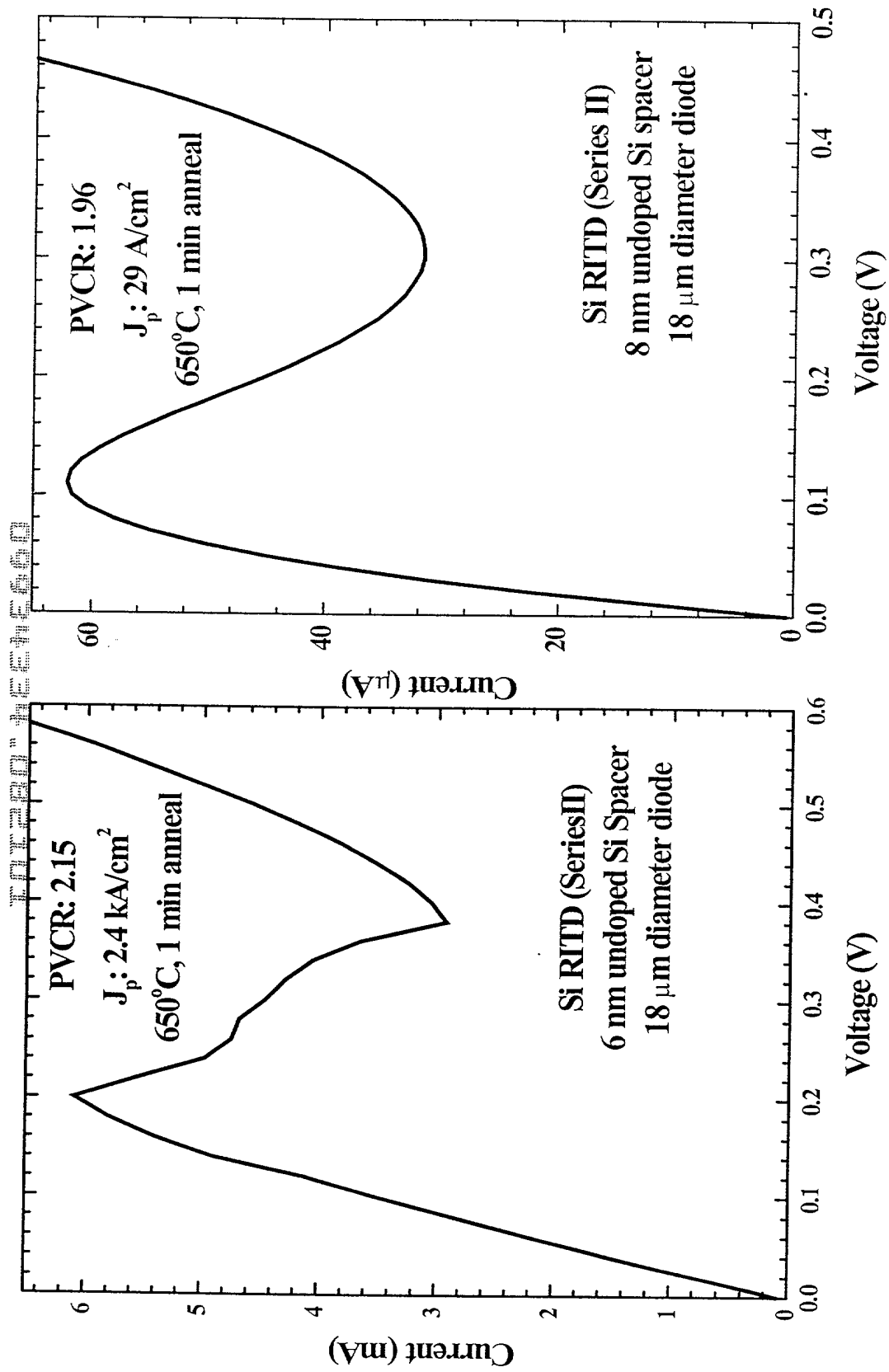


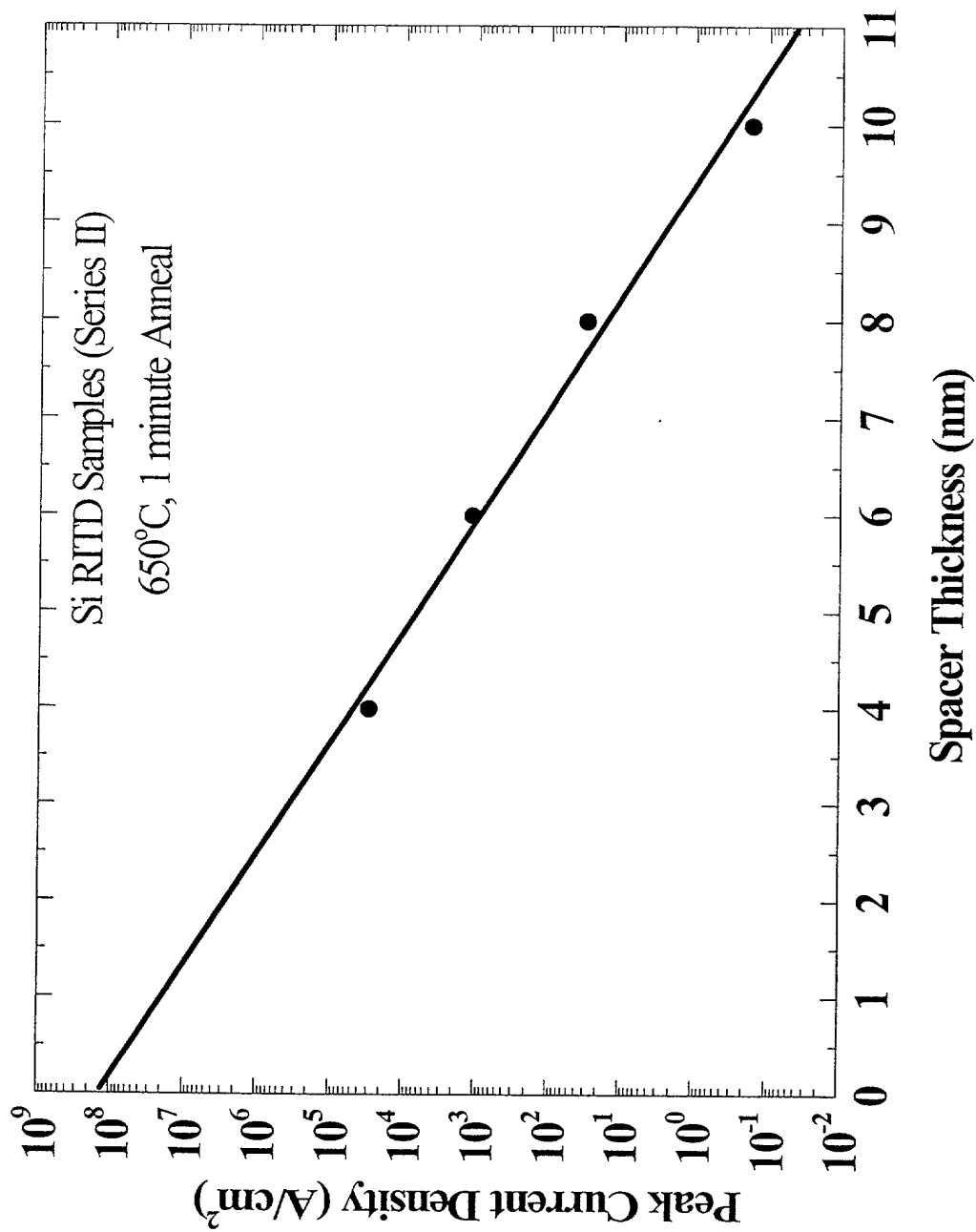
Figure 15

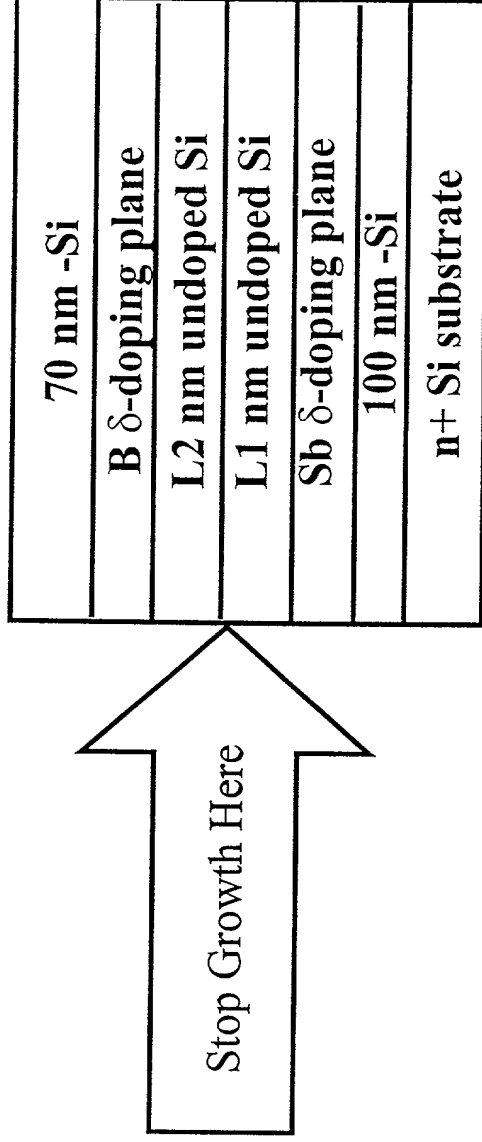


(a)

(b)

Figure 16

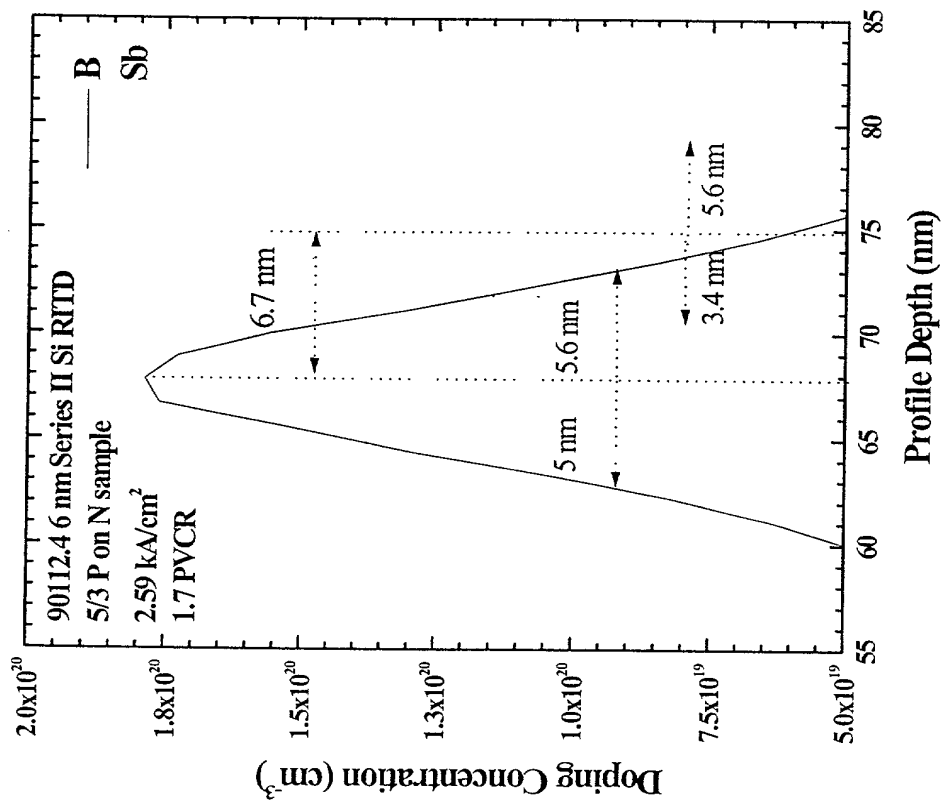
**Figure 17**



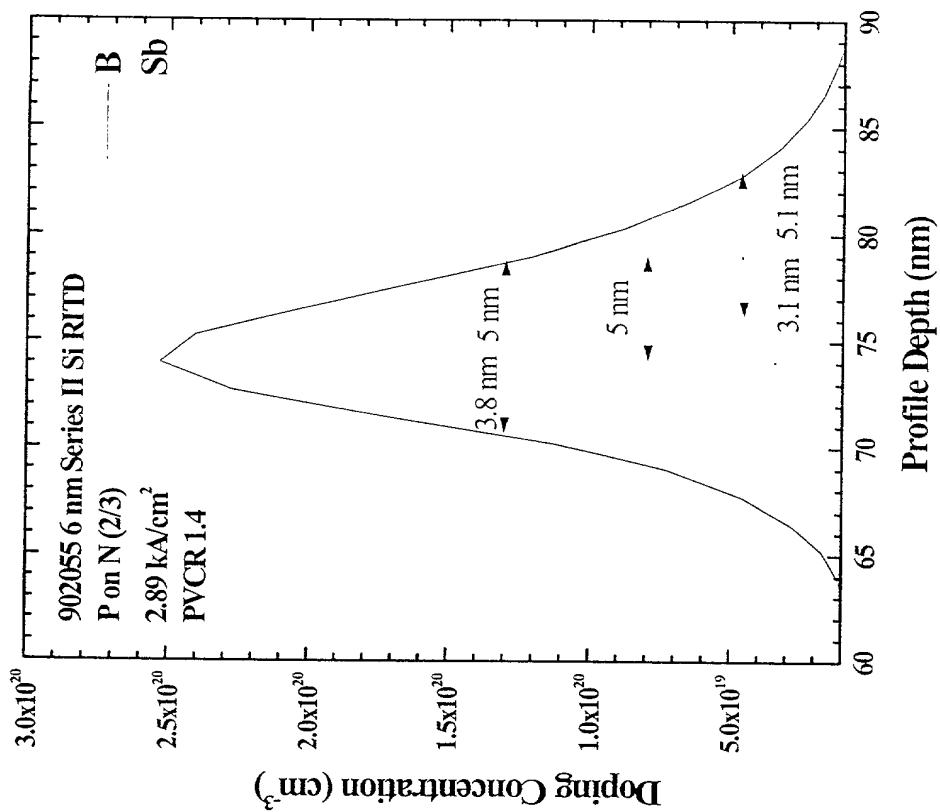
•Four combinations of L1 and L2 were examined:

- L1 = 5nm, L2= 9nm;
- L1= 5nm, L2=3nm;
- L1=2 nm, L2=3 nm;
- L1=2, L2=6 nm.

Figure 18

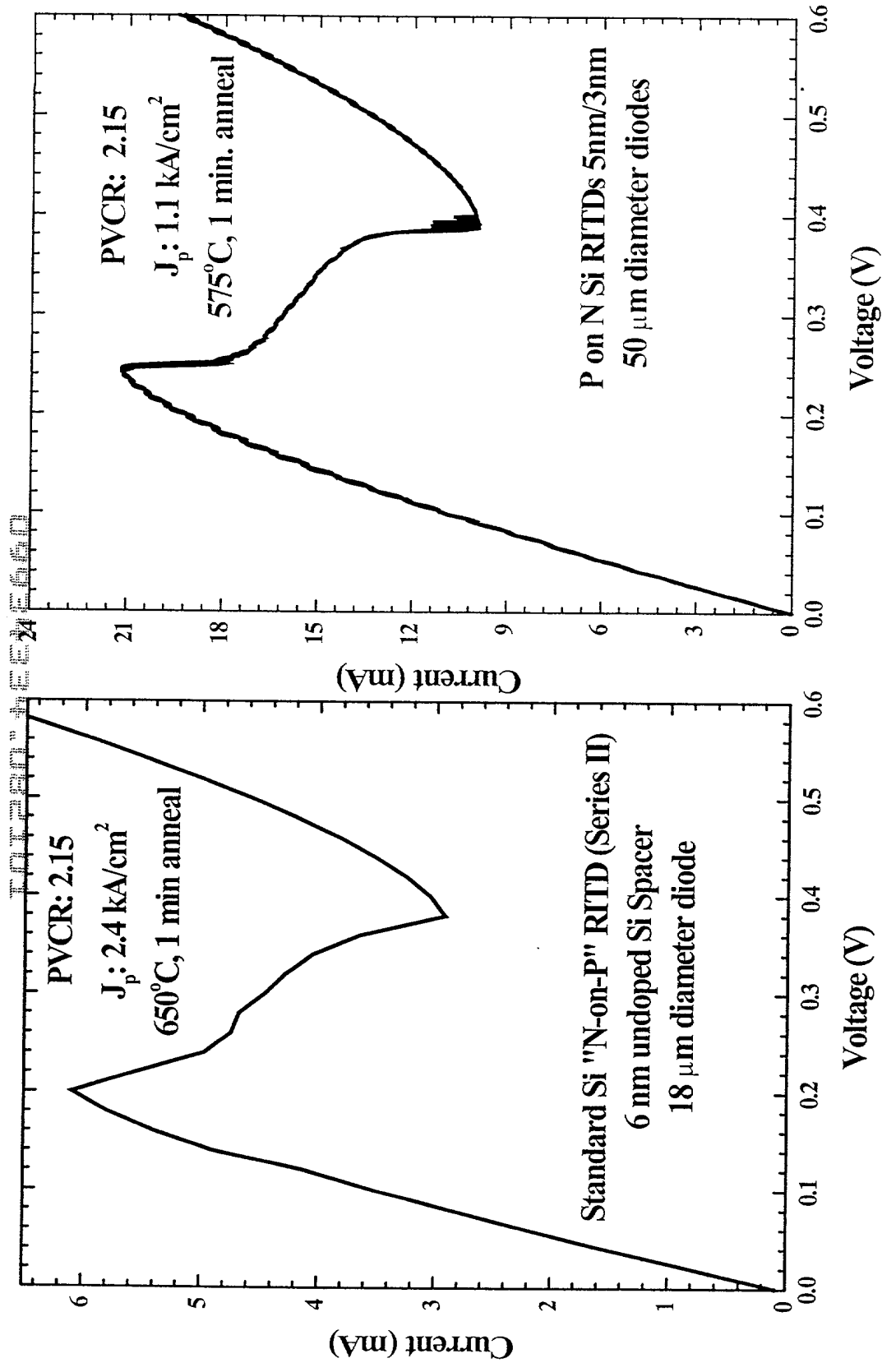


(a)



(b)

Figure 19



(a)

(b)

Figure 20

| |
|---------------------------|
| 70 nm p-Si |
| B δ -doping plane |
| 6 nm undoped Si |
| Sb δ -doping plane |
| 6 nm undoped Si |
| B δ -doping plane |
| 100 nm p-Si |
| p+ Si substrate |

Figure 21

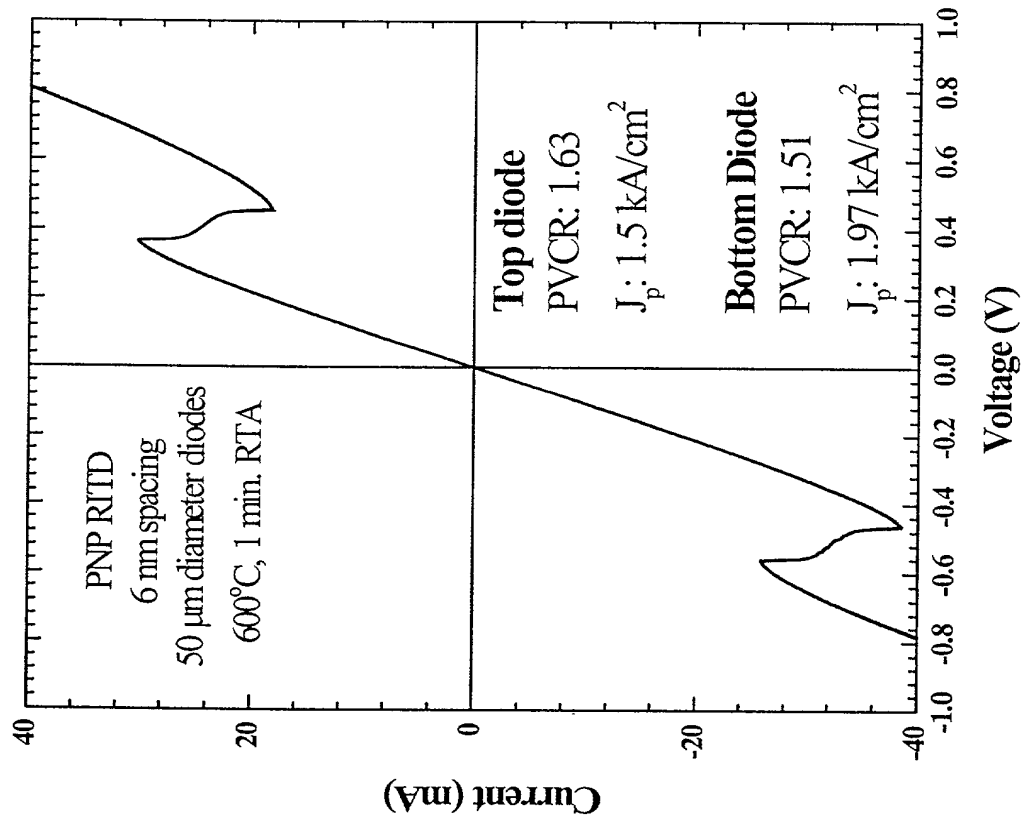


Figure 22

| Sample Number | Diode Diameter (μm) | Peak | | Peak Current | |
|------------------|-------------------------------------|-------------|-----------|------------------------------------|------|
| | | Voltage (V) | 700/800°C | Density (A/cm^2) | PVCR |
| RITD (TD1) | 18 | 0.35/0.12 | 2150/220 | 1.21/1.04 | |
| | 50 | 0.55/0.25 | 1720/180 | 1.18/1.04 | |
| | 75 | 0.68/0.36 | 1490/470 | 1.11/1.35 | |
| RITD (TD2) | 18 | 0.34/0.16 | 3230/520 | 1.54/1.18 | |
| | 50 | 0.87/0.38 | 2870/430 | 1.52/1.26 | |
| | 75 | 1.21/0.52 | 2690/470 | 1.48/1.30 | |

Table 1

1 minute anneal

| | | 500 C | 550 C | 600 C | 650 C | 700 C |
|--------------------|------------|-------|-------|-------|-------|-------|
| SiTD1 4 nm i-Si | Jp (A/cm2) | 1603 | 605 | 1360 | 872 | 172 |
| | Jv (A/cm2) | B/w | 523 | 982 | 648 | 149 |
| | PVCR | Diode | 1.15 | 1.38 | 1.35 | 1.15 |
| | | | | | | |
| SiTD2 2 nm i-Si | Jp (A/cm2) | 32000 | 15800 | 9400 | 1400 | 459 |
| | Jv (A/cm2) | 27000 | 14820 | 6500 | 1280 | 408 |
| | PVCR | 1.17 | 1.066 | 1.45 | 1.09 | 1.12 |
| | | | | | | |

•NDR was observed without an anneal for SiTD1 (PVCR 1.08 , J_p=3.93 kA/cm²)

Table 2

Table of "P on N" RTD Results

650°C, 1 min anneal

| <u>Layer</u> | <u>L_{before}</u> | <u>L_{after}</u> | <u>J_p</u> | <u>PVCR</u> |
|--------------|---------------------------|--------------------------|-------------------------|--------------------|
| 90205.6 | 2 nm | 6 nm | 115 A/cm ² | 1.2 |
| 90205.5 | 2 nm | 3 nm | 2.98 kA/cm ² | 1.3 |
| 90112.4 | 5 nm | 3 nm | 2.59 kA/cm ² | 1.7 |
| 90112.5 | 5 nm | 6 nm | 19 A/cm ² | 1.2 |
| 90112.6 | 5 nm | 9 nm | 12.7 A/cm ² | no PVCR-inflection |

- L_{before} refers to the length grown prior to the stop growth. L_{after} refers to the length after the stop growth.

Table 3